REMARKS

Claims 1-22 and 49 are pending in the present Application. Claim 1 has been amended, leaving Claims 1-22 and 49 for consideration upon entry of the present Amendment.

No new matter has been introduced by this amendment. Reconsideration and allowance of the claims are respectfully requested in view of the above amendment and the following remarks.

Amendment to the Claims

Claim 1 has been amended to delete "optional" to indicate that the electrically conductive precursor composition comprises a nanosized conductive filler. Support for this amendment can at least be found in the present application as filed, paragraphs [0005], [0011], and Examples 1-3.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-22 and 49 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over U.S. Patent No. 6,936,223 to Smalley et al. ("Smalley"). (Office Action dated 12/18/2006, page 2) Applicants respectfully traverse this rejection.

Smalley teaches a purification process that comprises heating the SWNT-containing felt under oxidizing conditions to remove the amorphous carbon deposits and other contaminating materials. (Abstract)

Presently claimed is a composition comprising an organic polymer precursor, a single wall nanotube composition containing at least 0.1 wt% of production related impurities, and as amended, a nanosized conductive filler. The conductive filler can have at least one dimension of less than or equal to about 100 nanometers. Suitable conductive fillers comprise carbon black, multiwall carbon nanotubes, vapor grown carbon fibers, conductive metal particles, conductive metal oxides, metal coated fillers, nanosized conducting organic/organometallic fillers, conductive polymers, or a combination comprising at least one of the foregoing. (Present application as filed, paragraphs [0005] and [0076]-[0096])

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a *prima facie* case of obviousness, i.e., that all elements of the invention are disclosed in the prior art; that the prior art relied upon, coupled with knowledge generally

available in the art at the time of the invention, contain some suggestion or incentive that would have motivated the skilled artisan to modify a reference or combined references; and that the proposed modification of the prior art had a reasonable expectation of success, determined from the vantage point of the skilled artisan at the time the invention was made. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970); *Amgen v. Chugai Pharmaceuticals Co.*, 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996).

Smalley discloses that:

> [i]t is possible to produce a composite fiber/polymer with anisotropic properties. This can, for example, be accomplished by dispersing a number of metallic carbon nanotube fibers in a prepolymer solution and using an external electric field to align the fibers, followed by polymerization. Electrically conductive components can also be formed using the metallic forms of carbon nanotubes.

(Smalley, column 40, lines 57-67)

Smalley however does not teach the use of nanosized conductive fillers as recited in amended claim 1. Specifically, Smalley does not teach the synergistic combination of single wall nanotubes ("SWNTs") and nanosized conductive fillers as presently claimed, which lead to improved resistivity and conductivity when used with an organic polymer precursor. This synergistic effect is demonstrated by the Applicants to produce a composition with significantly increased conductivity or reduced resistivity when compared to a composition with only a conductive filler, or SWNTs. For these reasons at least, Smalley does not teach all elements of the claimed invention.

In addition, Smalley discloses that it is possible to produce a composite fiber/polymer by dispersing a number of metallic carbon nanotube fibers (e.g., from (n,n) SWNTs) in a prepolymer solution (e.g. a poly methylmethacrylate). (Col. 40, lines 57-67) Based upon this disclosure, the Examiner has stated that a prepolymer is a polymer precursor. (Office Action dated Dec. 18, 2006, page 4) Applicants respectfully disagree.

In order to derive the conductive composition presently claimed, the organic polymer is polymerized from an organic polymer precursor while the SWNTs are dispersed in the organic polymer precursor. The organic polymer precursor may be a monomer, dimer, trimer, a molecular species having up to about 10 repeat units, or an oligomeric reactive species having up to about

40 repeat units. (see Paragraphs [0010] and [0016] of the instant application respectively) As described in these paragraphs, the precursor is then polymerized into the polymer. However, the example provided by Smalley of a prepolymer (poly methylmethacrylate), is not the same as the prepolymer envisioned by the Applicants. Poly methylmethacrylate as described by Smalley is inherently an acrylic polymer formed by the polymerization of monomers of methyl methacrylate. Poly methylmethacrylate is not a monomer, dimer, trimer or an oligomeric species having up to 40 repeat units as presently defined in Paragraphs [0010] and [0016] respectively. A polymer is generally construed as having more than 40 repeat units. The prepolymer solution provided by Smalley therefore differs from the polymer precursor claimed in the current invention. Thus, in addition to not teaching the nanosized conductive filler or the synergy between the single wall carbon nanotubes and the nanosized conductive filler, Smalley also does not teach a polymer precursor as presently claimed.

Since Smalley does not teach all elements of the claimed invention, there is no motivation for one of ordinary skill in the art to modify Smalley. One of ordinary skill in the art upon reading Smalley would not have been appraised of the fact that the addition of nanosized conductive fillers would have a significant effect on the electrical properties of a composition containing only single wall carbon nanotubes.

Further the claimed invention produces unexpected results. An examination of Example 1 shows that replacement of a portion of the single wall carbon nanotubes with carbon black, produces superior electrical conductivity in the electrically conductive composition as compared to a composition that just contains carbon black or single wall carbon nanotubes. For example in Table 1, Sample No. 1, that contains 1 wt% of carbon black, displays no electrical conductivity. Sample No. 3, that contains 0.1 wt% of single wall carbon nanotubes, depicts an electrical resistivity of 67 kohm-cm. This is despite the fact that both compositions contain on 1 wt% conductive filler, based on the total weight of the composition. This shows that the addition of a small amount of carbon nanotubes to a composition containing carbon black enhances electrical conductivity.

Sample Nos. 17 and 18 both contain only single wall carbon nanotubes (with more than 0.1 wt% impurities) in amounts of 0.3 and 0.5 wt% respectively. As can be seen in Table 1, when a portion of the single wall carbon nanotubes is replaced with carbon black (which has an

extremely small aspect ratio as compared with single wall carbon nanotubes), the resulting electrical conductivity for the composition either remains the same or improves. Such a result is unexpected.

In general, electrically conducting fillers with higher aspect rations, are capable of imparting electrical conductivity to insulating polymers when present in very small amounts. One of ordinary skill in the art would not expect that the substitution of a portion of the single wall carbon nanotubes (which have a high aspect ratio) with carbon black (which has a low aspect ratio) would enhance the electrical conductivity. However, a glance at Sample Nos. 12 – 14 shows that this is exactly what happens. In Sample No. 12, when a portion (50 wt%) of the single wall carbon nanotubes was replaced with the carbon black, the electrical resistivity did increase, but not by very much. This increase in electrical resistivity is only marginal and is certainly not representative of the amount of single wall carbon nanotubes replaced by the carbon black. In other words, one of ordinary skill in the art would have expected a greater decrease in electrical conductivity if 50 wt% of the single wall carbon nanotubes were replaced with carbon black. Thus, there is an unexpected synergy between the carbon black and the single wall carbon nanotubes that was hitherto not expected.

This synergy is clearly seen when Sample Nos. 13 and 14 are compared with the Sample No. 17. The results for Sample Nos. 13 and 14 (when compared with Sample No. 17) clearly show that when 20 wt% of the single wall carbon nanotubes are replaced with carbon black, the resulting electrical resistivity is decreased from 387 kohm-cm to between 40 to 60 kohm-cm. These results clearly show that there is an improvement in the electrical conductivity when a nanosized electrically conducting filler is added to a composition that contains single wall carbon nanotubes.

In this regard, the courts have held that "[A]n applicant can rebut a prima facie case of obviousness by presenting comparative test data showing that the claimed invention possesses unexpectedly improved properties or properties that the prior art does not have." *In re Dillon*, 919 F.2d 688, 692-93, 16 U.S.P.Q.2d 1987, 1901 (Fed. Cir. 1990).

For at least this reason, Applicants respectfully assert that Claim 1 as amended is patentable over Smalley under 35 U.S.C. § 103(a), and as a result so are claims 2-22 and 49 which depend from Claim 1. Withdrawal of the rejection and allowance of the claims is

respectfully requested.

Non Statutory Double Patenting Rejections

Claims 1-22 and 49 stand rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over Claims 1-50, 56-60 of copending Application No. 10/912,919.

Applicants thank the Examiner for pointing out the potential obviousness-type double patenting issue between the claims of the present application and those of co-pending Application No. 10/912,919. In view of the possibility that claims in the cited application or the present application will be further amended before allowance, Applicants will defer responding to this provisional rejection until claims in the reference application are allowed, claims in the present application are otherwise allowable, and it is determined whether this provisional rejection becomes an actual rejection.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and withdrawal of the objection(s) and rejection(s) and allowance of the case are respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 50-1131.

Respectfully submitted,

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